OCR GCSE 21ST CENTURY BIOLOGY B · J257

BIOLOGY



EXAM QUESTION PACK

B1.3 HOW CAN AND SHOULD GENE TECHNOLOGY BE USED? (HIGHER)

SCORE	PERCENTAGE
/54	%

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1(a). In 1991 a type of genetically modified tomato was being developed.

This tomato contained a gene from a fish called an arctic flounder.

Arctic flounder fish live in very cold conditions.

How would the tomato with the arctic flounder gene be useful to modern agriculture?

[1]

(b). Genetic modification has many wider applications.

Children who lack human growth hormone can be injected with a genetically engineered version so they grow as normally as possible.

The bacterium *Escherichia coli* is used as part of the genetic engineering process.

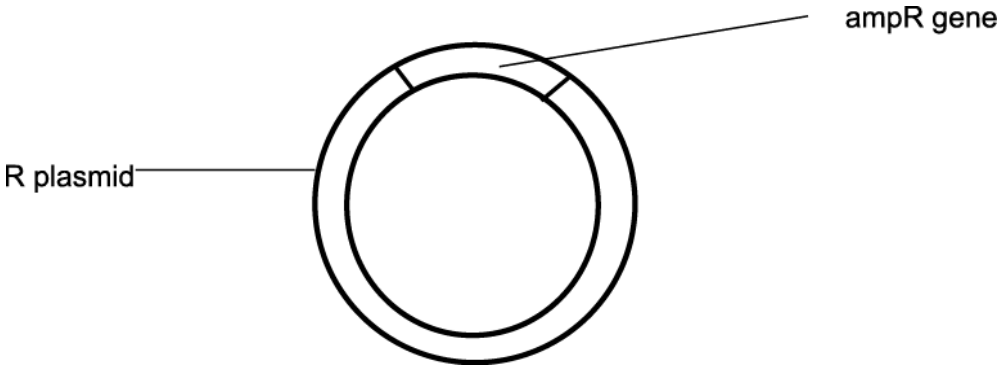
Use this information to describe how human growth hormone is made.

[3]

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2. Plasmids, such as the R plasmid shown below, may be found in bacteria.



What features of the R plasmid make it suitable as a **vector** in genetic engineering?

Use information in the diagram to help in your answer.

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[2]

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3(a). Scientists can genetically modify bacteria to make human insulin.

Describe procedures that scientists could use to genetically modify bacteria to make insulin and to identify the bacteria that have been successfully modified.



The quality of written communication will be assessed in your answer.

[6]

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(b). There are lots of reasons that make bacteria ideal organisms for genetic modification.
One of the statements below is **not** a good reason.

Put a ring around the statement that is **not** a good reason.

rapid reproduction

presence of plasmids

may cause disease

ability to make complex molecules

simple biochemistry

[1]

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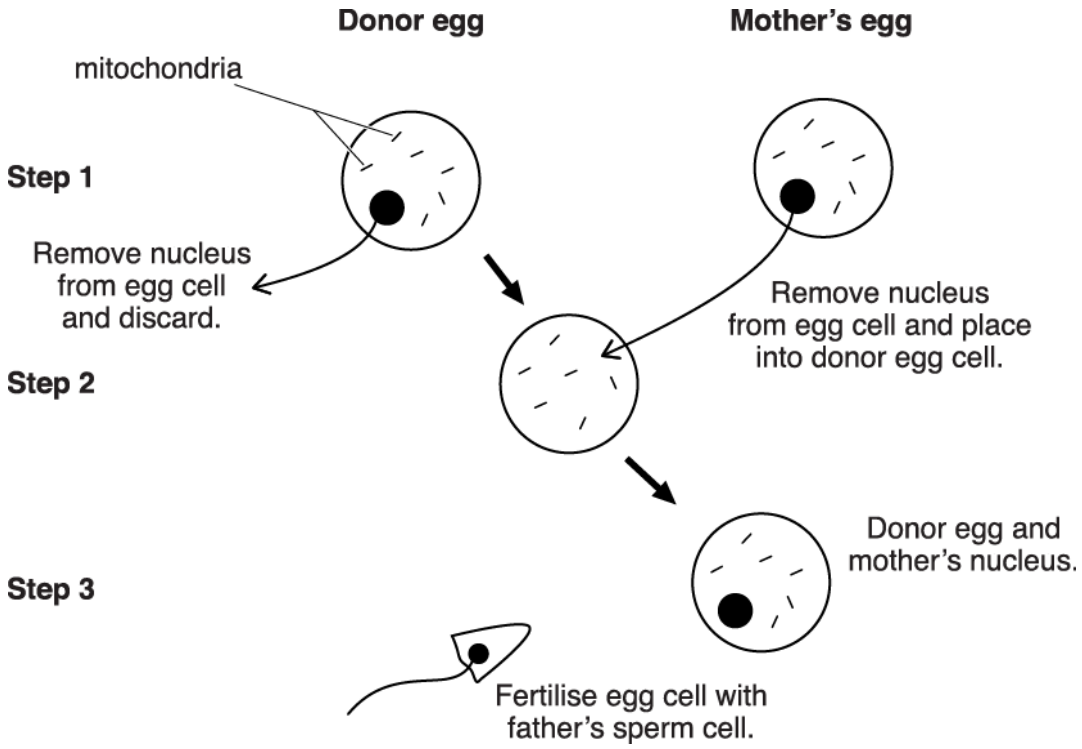
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4(a). Scientists use cell structures from three people to make a baby:

- the nucleus from a mother's egg cell
- the nucleus from a father's sperm cell
- the mitochondria from a donor's egg cell.

This technique will help prevent some genetic diseases caused by faulty mitochondria.

The diagram below shows how the process will be done.



Step 4 Fertilised egg cell is then placed in the mother's uterus.

Mitochondria contain 37 genes.

The nucleus of a fertilised egg cell contains 40 000 genes.

What percentage of its genes does the fertilised egg cell receive from the donor?

Give your answer to 2 decimal places.

Show your working.

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_____ % [2]

(b). Most of the baby's physical characteristics will be inherited from its father and mother.

Suggest why.

_____

_____

_____ [1]

(c). Genes code for proteins.

What type of protein could the genes in the mitochondria code for?

_____ [1]

(d). Babies created by this new technique will contain the DNA from 3 different individuals.

Some people do not agree with the use of this new technique.

Suggest and explain why.

_____

_____

_____

_____

_____ [3]

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(e). Approximately 1 in 200 children have faulty mitochondria.

1 in 6500 children will have serious diseases as a result.

Do you think this justifies the development of this new technique?

Explain your answer.

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[2]

(f). The DNA in the mitochondria of people affected by mitochondrial disease contains mutations.

A mutation is a change in the base sequence of the DNA.

Explain how these mutations can cause problems.

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[2]

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5.

(i) A doctor can prescribe drugs to treat heart disease.

It is now possible to genetically test people before prescribing drugs.

What are the benefits of this type of genetic testing?

Put ticks (✓) in the boxes next to the **three** correct answers.

Each drug works in the same way in every person. ☐

Less money is wasted prescribing drugs that don't work. ☐

Doctors don't have to learn about so many drugs. ☐

People won't have to visit the doctor any more. ☐

The drugs will always cure the patient from the disease. ☐

It may reduce the number of people who suffer dangerous side effects. ☐

The doctor can adjust the dose of the drug to suit the patient. ☐

[3]

(ii) Some people believe that this type of genetic testing should be compulsory for everyone.

Which of the following are **ethical** reasons why people might object to compulsory testing?

Put ticks (✓) in the boxes next to the **two** best **ethical** reasons.

Some people might be discriminated against when the test result is known. ☐

Some people might find the test painful. ☐

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It will cost too much money to test everyone. ☐

The results of the test might be inaccurate. ☐

Everyone should have the right to choose whether they are tested or not. ☐

[2]

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6. Harold has cystic fibrosis.

Hilda is a carrier for the disease.

Harold and Hilda are offered the chance to have a genetic test on their fetus before it is born.

Many people have concerns about the genetic testing of fetuses.

Describe **three** of these concerns.

1

2

3

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[3]

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7(a). Tim's father and grandfather both died from heart disease when they were 54 years old.

Tim is 35 years old.

His doctor tells him about a genetic test.

The test can predict how likely it is that he will develop heart disease.

Tim wants the test to tell him for certain whether or not he will develop heart disease.

Which of the statements are reasons why the test cannot do this?

Put ticks (✓) in the boxes next to the **three** best reasons.

A large number of people die from heart disease each year.	☐
Having a particular gene does not guarantee that you will develop heart disease.	☐
Tim's mother does not have heart disease.	☐
Tim's father and grandfather died from heart disease.	☐
The results of the test can sometimes be incorrect.	☐
There are lots of factors that can contribute to heart disease.	☐

[2]

(b). Suggest what implications the results of the test might have when Tim applies for life insurance.

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[2]

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8(a). Cystic fibrosis is an inherited disorder.

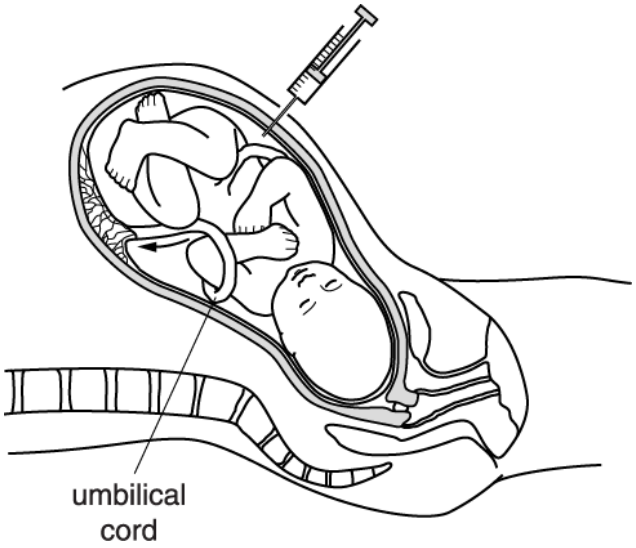
Sharon and Eric are both carriers for cystic fibrosis.

Sharon is pregnant. Eric is the father.

There is a chance that the fetus will have cystic fibrosis.

The fetus can be tested for cystic fibrosis.

This test usually involves pushing a long needle into the mother's uterus.



Cells from the fetus can then be removed and tested.

Scientists are developing a new method of collecting fetal cells.

They plan to remove a sample of the mother's blood from her arm.

This contains a very small number of fetal cells.

(i) Suggest **one** advantage of the current method that extracts fetal cells directly from the uterus.

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[1]

(ii) Suggest **one** advantage of the new method that extracts fetal cells from a sample of the mother's blood.

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[1]

(b). Sharon and Eric decide that they will have their fetus tested for cystic fibrosis.

Another couple, who are also both carriers for cystic fibrosis, decide not to have their fetus tested.

Discuss reasons why these two couples make a different decision about having their fetus tested.

The quality of written communication will be assessed in your answer.

[6]

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9(a). This question is about genetic modification.

There are many examples of genetic modification.
Which of the following can be achieved by genetic modification?
Put ticks (?) in the boxes next to the **two** correct answers.

sexual reproduction in plants	☐
bacterial synthesis of medicines	☐
testing for genetic disorders	☐
selective breeding	☐
asexual reproduction in animals	☐
herbicide resistance in crop plants	☐

[2]

(b). One example of genetic modification is the production of golden rice.
Golden rice has a gene inserted that produces vitamin A.
White rice does not contain vitamin A.
Countries with people who eat mainly white rice have high levels of blindness due to a lack of vitamin A.

Suggest why people in these countries may be more in favour of the genetic modification of organisms than people who live in the United Kingdom.

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[2]

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(c). People with haemophilia lack the gene to make the protein Factor 8 (Factor VIII).
As a result their blood cannot clot if they cut themselves.

Suggest how the process of genetic modification could be carried out to treat people with haemophilia.

The quality of written communication will be assessed in your answer.

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[6]

END OF QUESTION PAPER

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